EXHIBIT 60

United States Patent [19] [11] 4,090,223
Holt [45] May 16, 1978

[54] VIDEO SYSTEM FOR STORING AND RETRIEVING DOCUMENTARY INFORMATION

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[73] Assignee: Videofax Communications Corporation, Washington, D.C.

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[51] Int. Cl.[2] H04N 1/36
[52] U.S. Cl. 360/35; 360/72
[58] Field of Search .... 360/35, 72, 9, 10, 101; 340/173 DR

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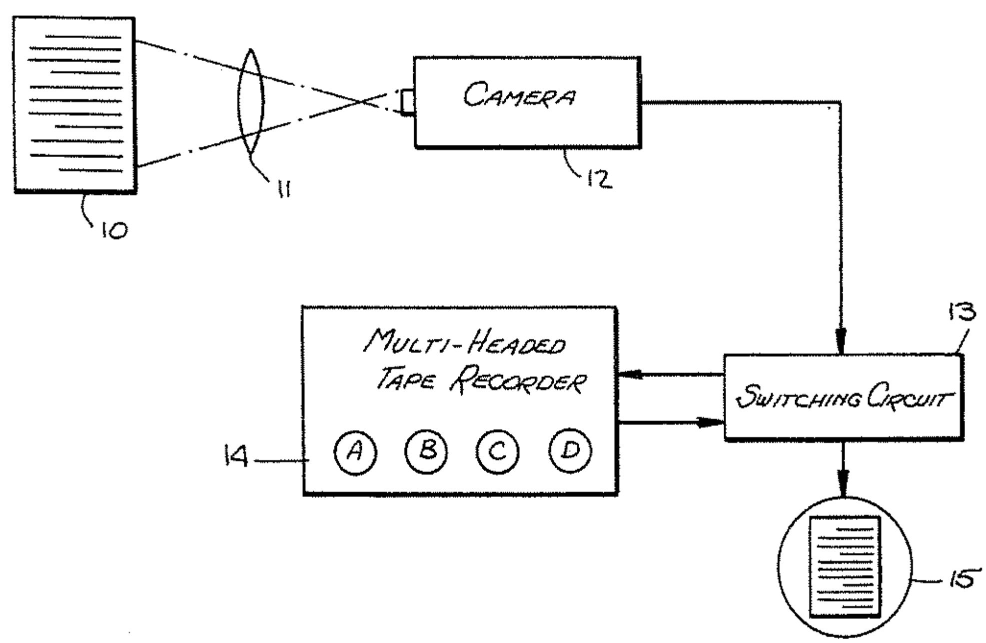
Attorney, Agent, or Firm—Michael Ebert

[57] ABSTRACT

A video system for storing and retrieving documentary information. In the storage mode, each document to be filed is scanned by a high-resolution video camera to produce a video signal representing a single image frame having a predetermined number of scan lines. The frame signal is electronically divided into a series of fields each having a like number of scan lines, the fields being applied successively to the recording heads of a multi-headed magnetic tape recorder in which the heads are vertically offset with respect to each other. The heads are mounted on a rotating arm and are caused thereby to sweep across a stationary magnetic tape to record the fields thereon in a set of parallel transverse tracks. The tape is indexed to store each document in a distinct set of tracks. In the playback mode, a selected set of tracks on the tape is presented to the heads which are then rotated to continuously yield a series of fields which are applied in the proper sequence to a high resolution video display device to recreate the selected document.

10 Claims, 11 Drawing Figures



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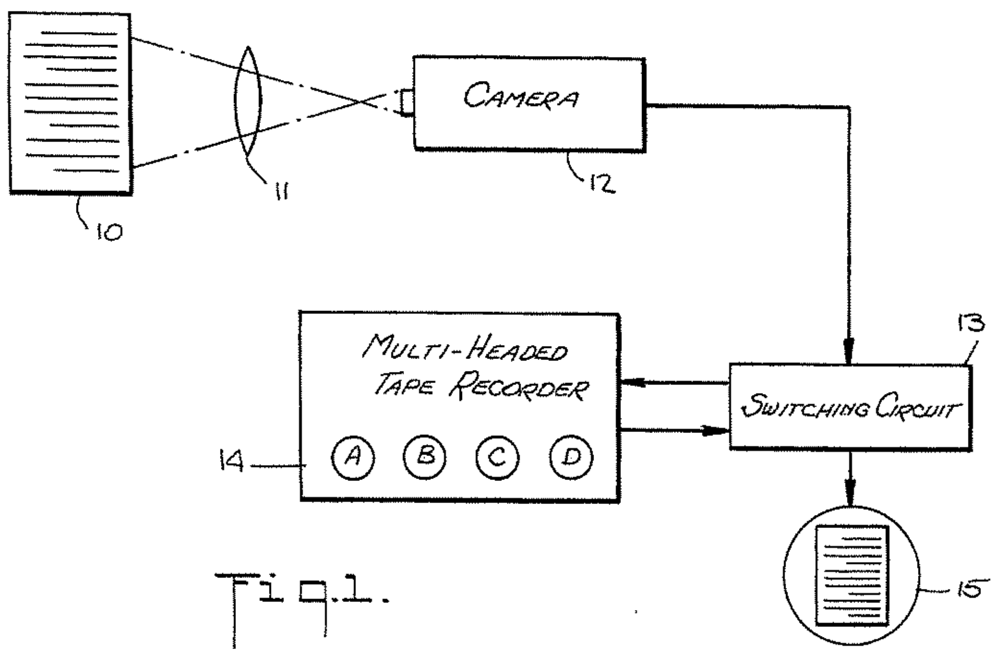


Fig. 1.

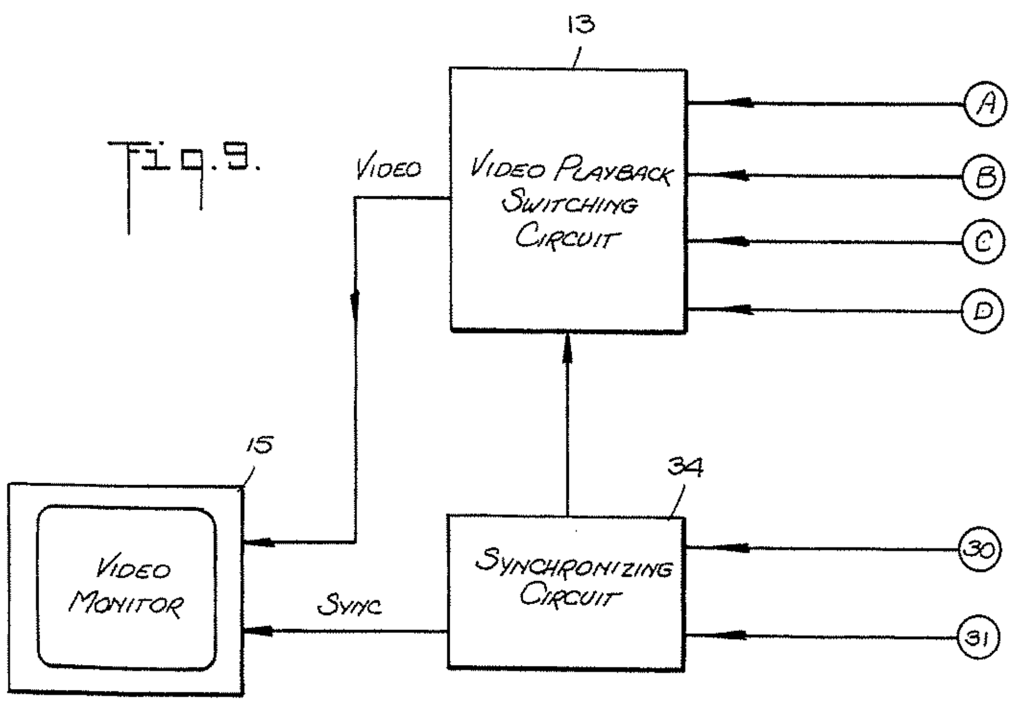


Fig. 9.

Fig. 2.

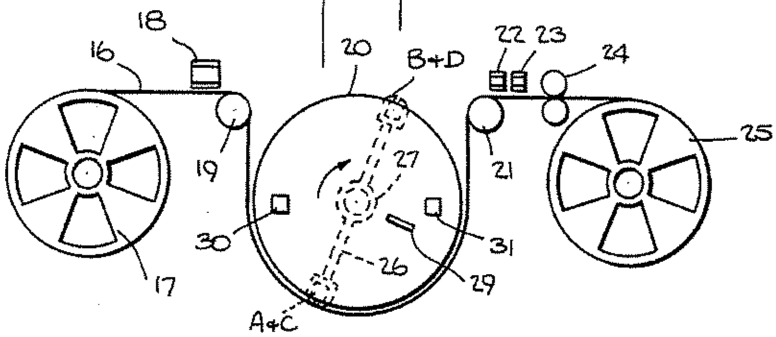


Fig. 3.

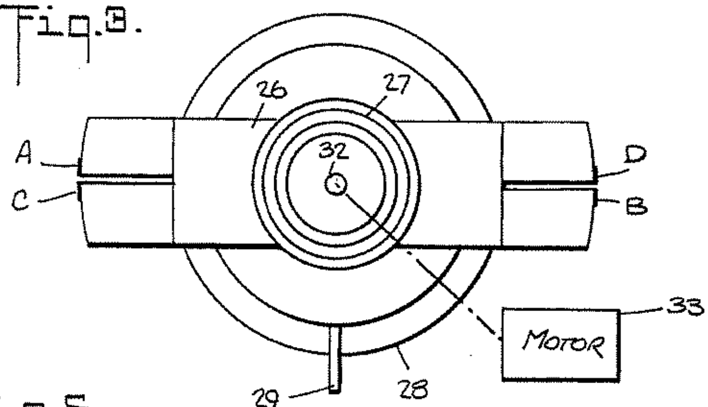


Fig. 5.

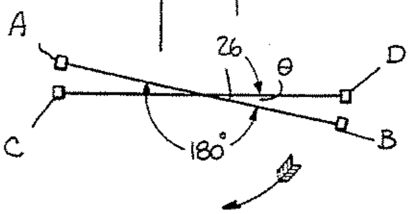
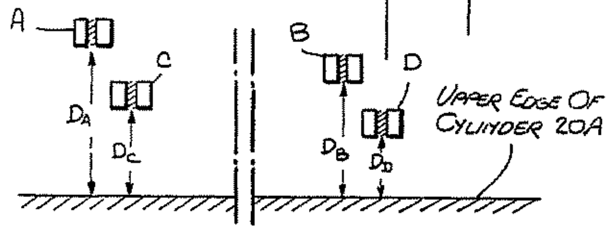


Fig. 4.



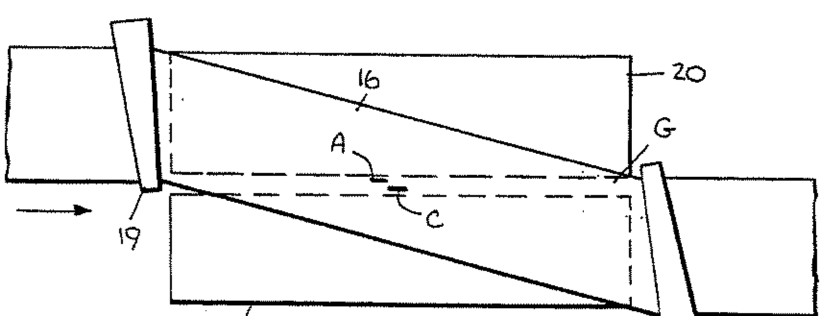


Fig. 6.

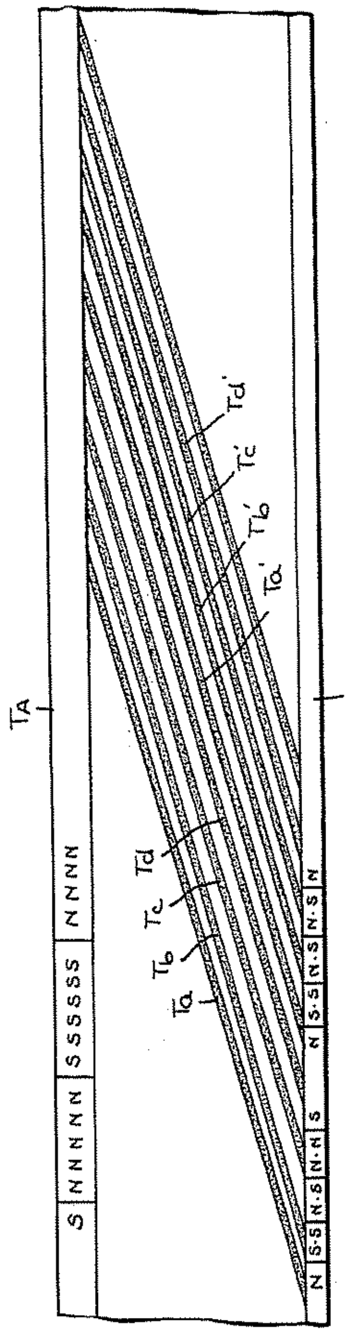


Fig. 7.

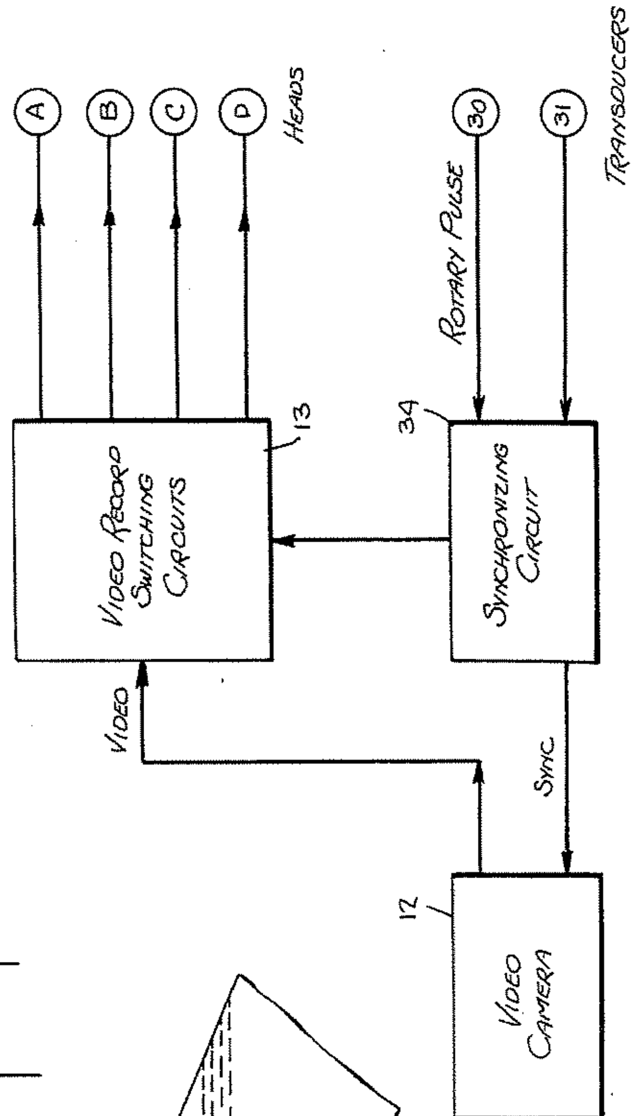


Fig. 8.

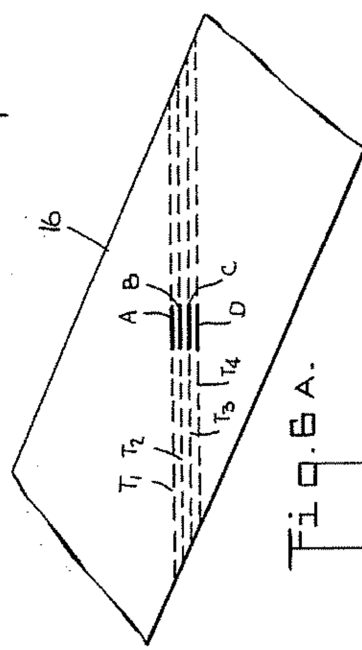
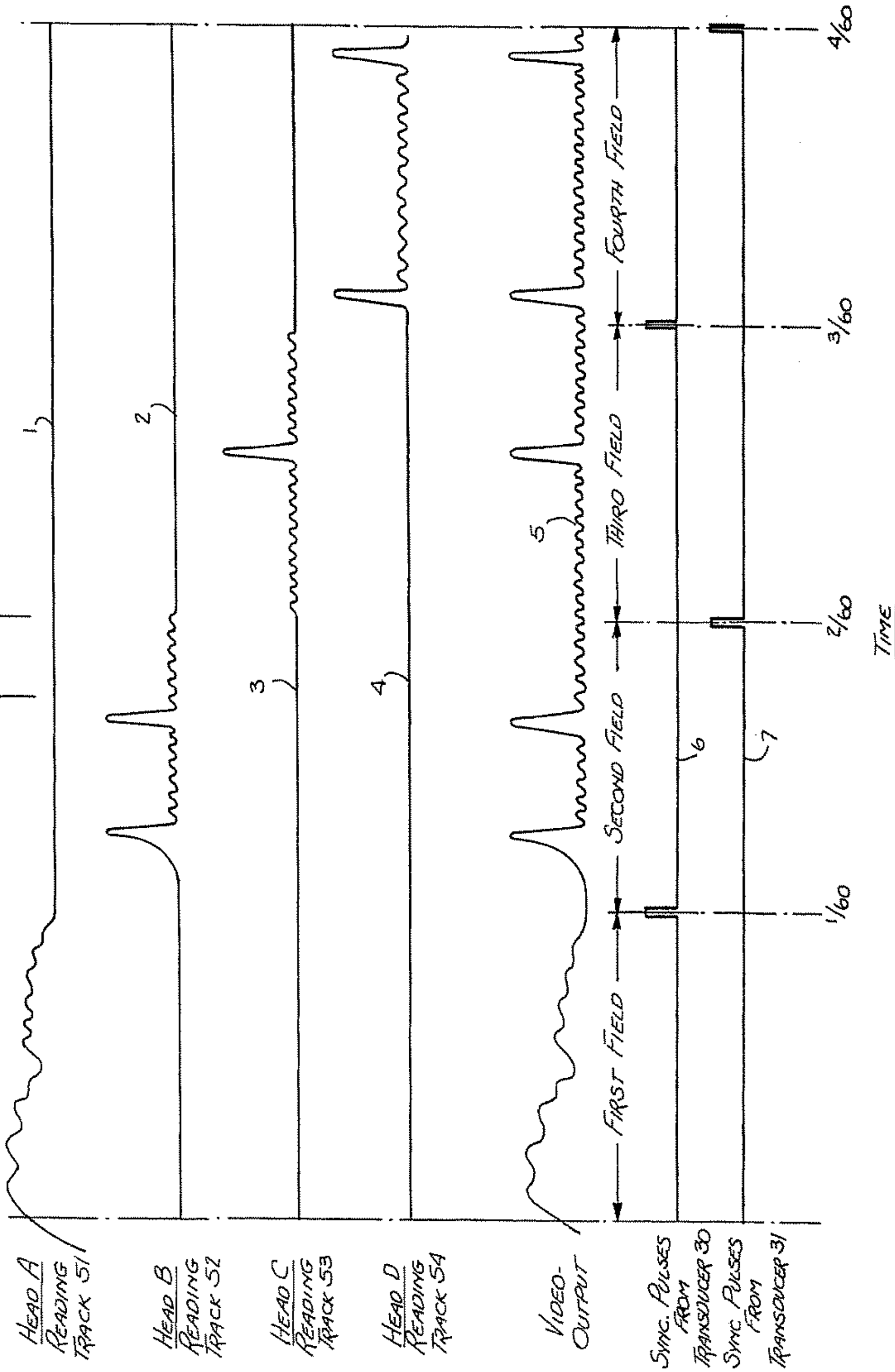


Fig. 8A.

AXD024552

Fig. 10.



HEAD A READING TRACK 51
HEAD B READING TRACK 52
HEAD C READING TRACK 53
HEAD D READING TRACK 54
VIDEO-OUTPUT
SYNC. PULSES FROM TRANSDUCER 30
SYNC PULSES FROM TRANSDUCER 31
FIRST FIELD
SECOND FIELD
THIRD FIELD
FOURTH FIELD
1/60
2/60
3/60
4/60
TIME
1
2
3
4
5
6
7

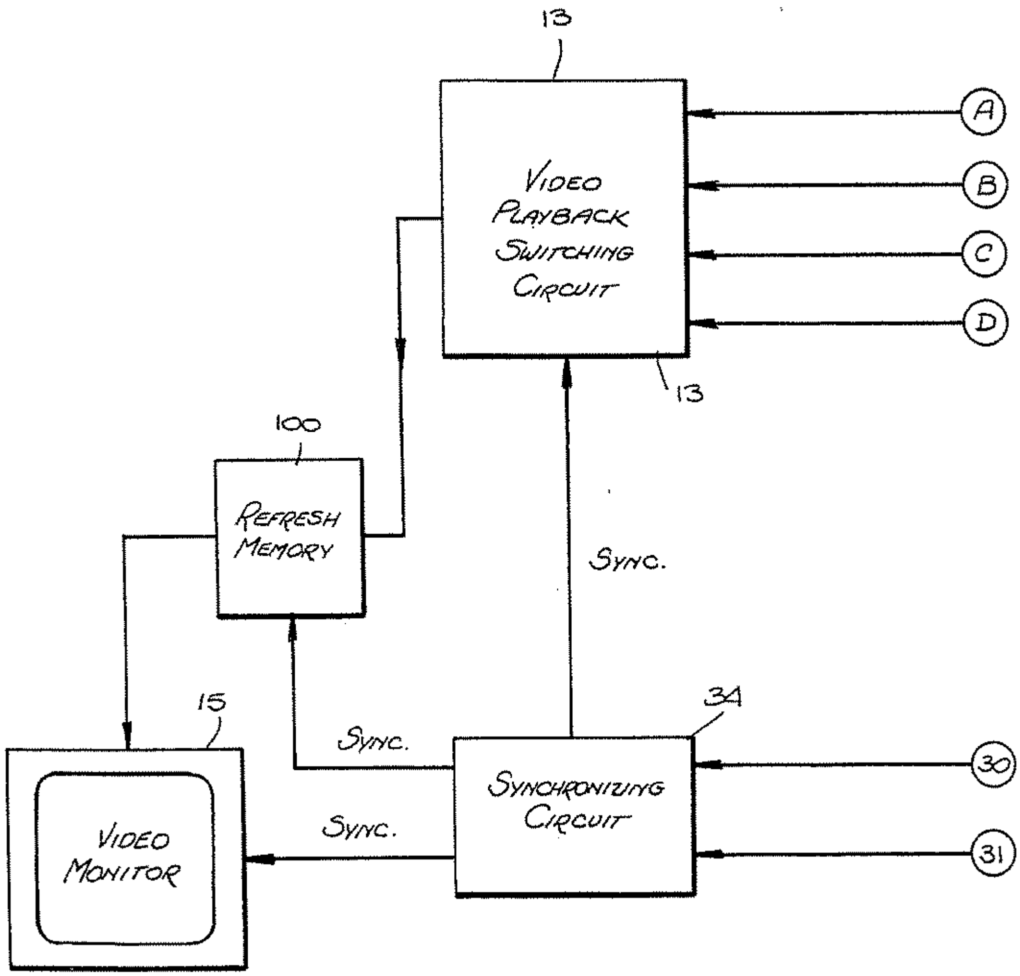

13
VIDEO PLAYBACK SWITCHING CIRCUIT
A
B
C
D
13
100
REFRESH MEMORY
SYNC.
15
34
SYNC.
VIDEO MONITOR
SYNC.
SYNCHRONIZING CIRCUIT
30
31

Fig. 11.

VIDEO SYSTEM FOR STORING AND RETRIEVING DOCUMENTARY INFORMATION

BACKGROUND OF THE INVENTION

This invention relates generally to video systems for the storage and retrieval of documentary information, and more particularly to a video system including a multi-head magnetic tape recorder for recording and playing back video images while the magnetic tape is stationary.

Video filing systems are known (see U.S. Pat. Nos. 3,594,729 and 3,514,537) which are adapted to record and store documentary information whereby a large body of information may be concentrated in a compact bank from which it can readily be retrieved on demand. In one such video filing system, paper documents are converted by a high-resolution video camera into corresponding high-resolution video image signals. These signals, together with identifying addresses, are automatically filed and stored on magnetic tape reels.

In this video filing system, any individual document page can automatically be retrieved, looked at in its original size, purged, reorganized with other images or shifted to various locations. An image of a recalled document is presented for viewing on a high-resolution television screen from which it can be reproduced as a hard copy. Since the document images are electronic in nature, filing and retrieval can be carried out remotely from a central file.

The crucial cost factor in a video filing system of this type lies in its means to store the documents as compact video images on magnetic tape which, when played back, are as readable as the original documents. The fact that commercial television systems afford clear images does not means that such systems are suitable for document storage and retrieval. There is a vast difference between being able to read on a T-V screen an 8½ × 11 inch document having more than a thousand characters printed on the page, and being able to see on the screen a picture of a house, for in the latter instance, gross detail is sufficient to give one a clear impression of a house, whereas in the former, small printed characters cannot be deciphered.

Thus a video filing system must employ high-resolution video means for recording and displaying documents. An electronic image of a document is created by scanning an optical image of the document focused on the photo-sensitive surface of the video camera tube. Scanning is effected by sweeping an electron beam across the sensitive surface, each sweep being a scan line. By the time the beam has sequentially scanned across the entire picture area from top to bottom, it has created an electronic image of the original document to complete an image frame.

The number of scan lines in an image frame determines one dimension of its resolution or readability. Resolution is a measure of how readable a document is when retrieved from the video picture. Commercial television in the United States has an established standard of 525 scan lines per frame. The resultant resolution is altogether inadequate for normal printed matter. Hence in one known video filing system, use is made of a high-resolution camera and a display tube having 1,280 scan lines in each frame. The other dimension involved in resolution is normally determined by the upper frequency limit of the system.

With a high-resolution system of the known type, the magnetic tape storage components and all other functioning elements of the system are designed to operate with the high-resolution scan line number. As a consequence of this requirement, use cannot be made of commercially-available video recording components designed to operate with the standard 525 scan line number per frame.

Another drawback of the known system which discourages its adoption is that when video signals from the storage bank are to be transmitted over common video carrier lines to a remote user terminal, one cannot use standard T-V transmission facilities for this purpose, for such facilities are incapable of conveying the frequencies of a high-resolution video signal. For example, even if a common video carrier line is capable of carrying a 7 megacycle high-resolution video signal as well as the standard 4 megacycle video signal, the associated synchronization system which is designed for the existing standard will not function with the high resolution signal. Hence, special carrier lines are called for, and this fact adds considerably to installation and operating costs.

The practical consequences of these restrictions are serious and have discouraged the adoption of video filing systems; for while standard components are mass-produced, high-resolution recording equipment is not an off-the-shelf item. High resolution devices must be custom-manufactured and inevitably are far more expensive than standard equipment.

With a view to overcoming the practical limitations of a video filing system of the above-described type, the Goldberger U.S. Pat. No. 3,803,352 discloses a hybrid high-resolution/low-resolution video information storage and retrieval system. The entire disclosure of this patent is incorporated herein by reference. In the Goldberger system, the video camera tube for converting the documents into video signals and the video display tube on whose screen the stored documents are reproduced both function as high-resolution devices with a scan line number per frame that is a predetermined multiple of the standard T-V low resolution number and with a frame repetition rate that is a complementary sub-multiple of the standard rate.

For example, in the Goldberger system, a preferred high-resolution frame line number is 1,575, which is exactly three times the standard 525-line number, in which event the sub-multiple is 10 frames per second, which is exactly one-third the standard frame repetition rate of 30 frames per second. Thus if the standard scan line number is multiplied by three, the frame rate is divided by the same factor.

As pointed out in the Goldberger patent, the multiple/sub-multiple relationship between the standard T-V values and the selected high-resolution T-V values need not be 3:⅓ but may be higher, such as 4:¼ or 5:1/5. For purposes of illustrating the present invention, a 2:½ relationship has been chosen, but it will be apparent that other relationships are feasible.

The video signals generated by the high-resolution camera in the Goldberger system are stored in a standard low-resolution magnetic storage device. In order to reconcile this low-resolution apparatus with the high-resolution camera and with a high-resolution display tube, a buffer is provided that functions to divide the video signals representing a single image frame into distinct signal fields, each having a scan line number equal to the standard line number per frame within a

time period equal to the full frame period of the standard frame repetition rate.

For this purpose, Goldberger makes use of a buffer to temporarily record and store a single frame, the buffer being in the form of a disc-type recorder whose operation is controlled by a switching circuit. The buffer is adapted to accept the 1,575 line per frame video signal (10 frames per second) from the camera and to divide this signal equally among three parallel continuous tracks on the disc recorder, whereby the first 525 lines of the full frame, which appear during a one-thirtieth of a second interval, go to the first continuous track, the second 525 lines, which appear in the next one-thirtieth of a second, go to the second continuous track, and the final 525 lines of the same frame, which appear in the last one-thirtieth of a second, go to the third continuous track. Thus the high-resolution video signal is divided into three equal signal fields, each of which has the standard scan line number and frame repetition ratio. However, each field represents only one-third of the total high-resolution frame.

In playback, the buffer disc is continuously rotated to repeat the image frames to provide a stationary image on the T-V screen for as long as the user requires the image. With a low-resolution disc recorder in which the course of a full disc revolution takes place in one-thirtieth of a second, a recording of a single high-resolution frame from the video camera takes place sequentially on three tracks in the course of three revolutions. Thus, a full high-resolution frame composed of three signal fields is recorded in one-tenth of a second.

If one were to play back any one continuous track on the disc on a standard T-V display tube, one would see only a third of the original document, which would appear at the standard 525 line–30 frame per second rate. In order, therefore, to reconstruct the document, all three tracks must be played back in sequence.

The buffer disc recorder is provided with a unitary assembly of three recording heads, each associated with one of the three tracks in a disc having a large number of concentric tracks. The switching circuit, which is controlled by the T-V camera, acts to render the first head operative for the first signal section of 525 lines, the second head being rendered operative for the next 525 lines and the third head for the final 525 lines.

Thus the three continuous tracks on the buffer disc are recorded in sequence. When another document is to be recorded, the tri-head assembly is automatically mechanically indexed to the next set of three tracks on the disc. Since the buffer disc serves only for temporary storage, means are provided to erase the recordings after the buffer has performed its required function. Since a document frame appears in a set of three continuous tracks on the buffer disc, it may be transferred to the magnetic tape recorder which is in the standard format.

Hence in the Goldberger system, in order to store the high-resolution video signals produced by the high-resolution camera, the signals must be recorded temporarily on the separate track of a rotating buffer disc and then transferred from the buffer disc to magnetic tape for permanent storage therein, whereas in the playback mode, the fields recorded on the magnetic tape must be returned to the disc and from there fed to the high-resolution display tube.

SUMMARY OF INVENTION

In view of the foregoing, it is the main object of this invention to provide in a hybrid high-resolution/low-resolution information storage and retrieval video system a multi-headed video tape recording and playback arrangement functioning to divide the video signals from the high-resolution camera into signal fields and to permanently record these fields on a stationary magnetic tape.

In contradistinction to the Goldberger arrangement, in the present system there is no need for temporary recording, for the field signals sequentially applied to the respective heads of the recorder are directly recorded on the stationary magnetic tape.

Also an object of the invention is to provide a relatively simple yet efficient video system for storing and retrieving documentary information which operates efficiently and reliably and which may be manufactured at low cost.

Among the advantages gained by the present invention are the following:

A. As distinguished from a moving tape system, the present system, which uses a stationary tape, itself provides a "refresh memory" to keep intelligence flowing into a CRT monitor during playback.

B. Synchronization of the stationary tape video recorder with any other video source or sync device is much simpler than for a moving tape recorder.

C. The time required for establishing synchronization between a moving tape and a rotating head is saved—an important factor in many systems.

D. No buffer memory external to the stationary tape system is necessary during recording.

Briefly stated, these objects and advantages are attained in a system which in the storage mode scans each document to be filed with a high-resolution video camera to produce a video signal representing a single image frame having a predetermined number of scan lines.

The frame signal is electronically divided into a series of fields each having a like number of scan lines, the fields being successively applied to the recording heads of a multi-headed magnetic tape recorder in which the heads are vertically offset with respect to each other. The heads are mounted on a rotating arm and are caused thereby to sweep across a stationary magnetic tape to transversely record the fields thereon in a set of parallel tracks. The tape is indexed to store each document in a distinct set of tracks. Also recorded on the tape along longitudinal tracks are position control and address information for accurate positioning of the tape and to facilitate retrieval of the recorded information.

In the playback mode, the tape is advanced to present to the heads a desired track set, and the heads are then rotated to continuously yield a series of fields which are applied in the proper sequence to a high-resolution video display device to repeatedly reconstitute the image frame and thereby recreate the document selected from the magnetic tape file.

OUTLINE OF DRAWING

For a better understanding of the invention as well as other objects and further features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a simplified block diagram of a video system in accordance with the invention for storing and retrieving documentary information;

FIG. 2 schematically illustrates the magnetic tape recorder included in the system;

FIG. 3 is a plan view of the rotating head assembly;

FIG. 4 illustrates the manner in which the magnetic recording heads are offset with respect to each other;

FIG. 5 shows the angular relationship of the recording heads;

FIG. 6, consisting of 6 and 6A, is an elevational view of the stationary cylinders within which the head assembly rotates, and FIG. 6A illustrates the relationship of the heads of the assembly to the magnetic tape;

FIG. 7 illustrates the various tracks recorded on the magnetic tape;

FIG. 8 is a block diagram of the video system in the storage mode;

FIG. 9 is a block diagram of the video system in the playback mode;

FIG. 10 illustrates the wave forms of the signals yielded by the various heads in the playback mode; and

FIG. 11 is a block diagram of a system in accordance with the invention which incorporates a Refresh Memory.

DESCRIPTION OF INVENTION

The General System

Referring now to FIG. 1, there is shown in simplified form, the basic components of a video system for storing and retrieving documentary information. Information, represented by a printed document 10, is placed on an illuminated platen. An optical image thereof is focused by a suitable lens assembly 11 onto the photosensitive surface of a high-resolution T-V camera tube 12. In the camera tube, an electron beam sweeps across the photosensitive surface to generate a video signal representing the varying brightness of the picture elements constituting the document image.

We shall, for purposes of illustration, provide the necessary high resolution by using a frame line number of 1050 lines per frame, which is two times higher than the standard 525 frame line number. The high-resolution frames have a repetition rate of 15 frames per second, which is one half the standard repetition rate of 30 frames per second. There are four standard fields per frame.

In the storage mode, when documents are to be recorded, the high-resolution video signal yielded by camera 12 is fed through an electronic switching circuit 13 to the respective heads of a multi-headed magnetic recorder 14 which, in this example, has four heads, A, B, C and D, a pair of which are mounted on one end of a rotating arm and the other pair on the opposing arm. The switching circuit acts effectively to divide the frame signal of 1050 lines into four distinct fields having a like number of lines (262½), each field being produced within a 1/60th of a second interval. Thus each field is very nearly identical to a field in standard low-resolution television.

The heads are vertically offset with respect to each other and are caused by the rotating arm to sweep across a magnetic tape while the tape is stationary so that two heads traverse separate tracks on the tape in the course of one arm rotation. Two revolutions are therefore necessary to record four tracks.

The head positions and switching sequence are such that first the head to which the first field is applied

sweeps across the tape to record the first track, and when the first head departs from the tape, the second head to which the second field is applied then proceeds to record the second track in a position parallel to the first track, and so on, until the four fields are recorded to form a set of four parallel tracks.

To record the various documents, the tape is indexed after each set of tracks is recorded to present a fresh tape zone for recording the set of four tracks representing the next document. Address information is also recorded along the edge of the tape to facilitate the retrieval of the recorded information. A longitudinally-extending control track is also provided for accurate positioning of the tape. While the field image tracks are made by rotating the recording heads, the address and control tracks are made, as will later be explained, by stationary heads.

In the playback mode, when on wishes to retrieve a particular document, the set of four tracks recorded on the tape which together represent the document are first located by means of the address, and the four tracks are played back in the proper sequence by means of switching circuit 13 operating in the playback mode. The playback is continuous to recreate the high-resolution 1050 line frame signal. This signal is applied to a high-resolution T-V display device 15.

The Multi-Headed Recorder

Referring now to FIG. 2, there is shown the transport mechanism of a tape recorder in accordance with the invention. The magnetic tape 16 to be recorded is wound on a supply reel 17, the tape being typically ½ inch wide and 2000 feet long.

Tape 16, when it is drawn from reel 17, first passes by an erase head 18 which functions to remove any previous recording. The tape then turns about an idler 19 from which it is carried around the periphery of a pair of split stationary cylinders 20 and 20A (see FIG. 6) and about an idler 21. Next in the tape path we find an addressing magnetic head 22 followed by a locator magnetic head 23, the former being used to approximately locate the position of any section of the tape and the latter for precise location of the desired tape signals.

A pair of pinch rollers 24 acts to pull tape 16 through the mechanism when such movement is necessary, the tape then being rewound on a take-up spool 25. Mounted for rotation about a shaft coaxial with split cylinders 20 and 20A, is the arm 26 of the rotating head assembly. Supported on one end of arm 26 is a pair of magnetic recording heads A and C, and on the other end thereof is a pair of recording heads B and D. Electrical connections to these heads are made through concentric slip rings 27. The arm rotates in a horizontal plane extending through the gap G between cylinders 20 and 20A.

Underlying arm 26 and rotating therewith is a ring 28 having a permanent magnet 29 mounted thereon. Magnet 29 is operatively associated with a pair of diametrically-opposed stationary magnetic transducers 30 and 31, such that when magnet 29, in the course of a rotating cycle, intercepts each of these transducers, a pulse is generated thereby, indicative of the angular position of the arm.

As shown in FIG. 6, idler 19 is disposed adjacent upper cylinder 20, whereas idler 21 is adjacent lower cylinder 20A, the shape and position of these idlers being such as to cause tape 16 to make a wrap of approx-

imately 190° around both cylinders **20** and **20A**. Thus tape **16** in advance of idler **19** extends along a horizontal path at the same level as cylinder **20**, then the tape is skewed to embrace the cylinders. The tape leaving idler **29** then resumes a horizontal path extending at the same level as the lower cylinder.

As illustrated in FIGS. **4** and **5**, heads A and C which are mounted on one end of arm **26** are both horizontally and vertically offset with respect to each other, and heads B and D mounted on the other end of this arm are similarly offset so that each head which passes through gap G in the course of arm rotation occupies a distinct vertical position, one above the other.

In a preferred form, recording heads A and C, rather than being horizontally offset, would be vertically stacked one above the other, as would be the case for heads B and D, inasmuch as the present system only requires a vertical displacement of the four heads (or whatever other number of heads is used). However, because of head thickness and gap size as well as other practical considerations, a side-by-side configuration, as shown, represents an acceptable compromise.

The rotating head assembly is mounted on a shaft **32** operatively coupled to a motor **33** which drives the assembly at 1800 rpm. Thus in the course of one revolution, head A, operating within gap G, sweeps across that portion of stationary tape **16** which is wrapped about cylinders **20** and **20A** to record a track thereacross at a position determined by the vertical level of this head.

In the course of the same revolution, head B, whose position on the arm is diametrically opposed to that of head A, sweeps across the tape to record a second track thereacross which is parallel to the first track, since it is at a slightly lower level than head A. In the course of the second revolution of the assembly, heads C and D produce parallel third and fourth tracks.

The switching arrangement associated with the heads is such that the frame signal from the video camera is divided into four fields which are applied in sequence to heads A, B, C and D, so that these fields are recorded on the stationary tape in a set for four parallel tracks.

The geometric relationship of heads A, B, C and D to tape **16** can best be appreciated from FIG. **6A**, where it will be seen that heads A, B, C and D form a vertical stack and serve to create a set of horizontal tracks T_1, T_2, T_3 and T_4 across tape **16** which is skewed relative to the heads. But tape **16** not only has the transverse recordings thereon produced by the rotating head assembly but, as shown in FIG. **7**, it also carries longitudinal recordings on the edge of the tape, track T_A being an address track, and track T_L being a locator track.

Operation in Storage Mode

Referring now to FIG. **8**, the system arrangement in the storage mode is illustrated in simplified form. It will be seen that the video frame signal from video camera **12** is fed through switching circuit **13** to recording heads A, B, C and D of the rotating head assembly whereby the frame signal is divided into four fields having a like number of scan lines which are applied in sequence to heads A to D.

Synchronization is effected by a synchronization circuit **34** which is responsive to the pulses generated by fixed transducers **30** and **31**, these pulses being produced at 180° intervals in the course of each rotation of the head assembly.

We shall assume, at the outset of operation in this mode, that the tape has been completely erased by the bulk erase head **18**. Before documentary information is filed on the tape, the entire tape is run through the recorder and positional information is entered therein by stationary heads **22** and **23** (FIG. **2**), along the longitudinally-extending address and locator tracks T_A and T_L.

We shall now make a recording at a particular track site. This effected by advancing the tape until the desired address thereon is found by address head **22** which reads address track T_A. The precise tape location is found by locating head T_L which reads track T_L. At this point, tape movement is arrested and the tape remains stationary during the recording of one entire video frame signal representing the particular document to be filed.

In making this recording, the head assembly carrying recording heads A to D is rotated, in the course of which pulses are produced by transducers **30** and **31** when they are intercepted by the rotating permanent magnet **29** (FIG. **3**). These pulses are indicative of the angular position of the arm and occur at the instant when the recording heads are to be switched. Synchronizing circuit **34** conditions these pulses and applies them as sync pulses to switching circuit **13** as well as to video camera **13**.

Camera **12** scans the document to produce a video frame signal having 1050 lines in 1/15 seconds. This video frame signal is divided into four fields each constituted by 525 lines in 1/60th of a second. The four fields are applied sequentially by switching circuit **13** to heads A, B, C and D which record the fields on tracks T_a, T_b, T_c and T_d on the tape to produce a set of tracks representing the filed document, as shown in FIG. **7**.

In operation, as head A is just leaving track T_a, head B, which is displaced 180° from head A then enters track T_b. 180° later, when head B is just clearing track T_c, head C then enters track T_c. Finally, as head C is just leaving track T_c, head D, which is displaced 180° from head C, enters track T_d to complete the recording. It therefore takes two revolutions of the head assembly to record a set of four tracks on the stationary tape.

The relationship of the heads to the video frame signal (**1050** lines) and the sync pulse is illustrated graphically in FIG. **10**. The wave form of the video frame signal is shown by line **5**, this signal being developed during a scanning period running 4/60th of a second. This period is divided by sync pulses produced by transducers **30** and **31**, which pulses occur at 180° intervals, so that in the course of two rotations, pulses are produced at 1/60th of a second intervals, thereby dividing the frame signal into four fields each having a 1/60th of a second duration and 262½ lines.

Head A is switched on to record the first field, as shown in line **1**, after which head B is switched on to record the second field, as shown in line **2**. Then head C is switched on to record the third field, after which head D is switched on to record the fourth field, the instants of switching being coincident with the sync pulses.

If one now wishes to record another frame, the tape is indexed approximately ½ inch longitudinally, so that now heads A, B, C and D are aligned with tracks $T_{a'}$, $T_{b'}$, $T_{c'}$, and $T_{d'}$, as shown in FIG. **7**. The recording operation is repeated to enter the second frame on the tape.

Thus in the storage mode, high-resolution signals, each representing a document frame, are converted into signal fields suitable for storage on standard low-resolution recording tape, these fields being reconstituted in the playback mode into a high-resolution signal suitable for display.

Operation in Retrieval Mode

The video signal frame just recorded may be played back using the arrangement shown in FIG. 9, where now the heads A, B, C and D function as playback heads whose outputs go to switching circuit **13** so as to apply the signals from tracks T_a, T_b, T_c and T_d in sequence to the video display device or monitor **15**.

Monitor **15** and switching circuit **13** is supplied with sync pulses by synchronization circuit **34** which is actuated by pulses derived from transducers **30** and **31** whereby a sync pulse is produced every 180° in the course of rotation of the head assembly. Thus the electron beam in the monitor is caused to trace a field and frame pattern similar to that which the video camera originally traced.

It is to be noted that in the course of two revolutions of the head assembly, each head scans its associated track on the tape device twice, thereby playing back the recorded field twice. But only one of the two fields derived from each head is fed to the monitor by the switching circuit.

The recorded head assembly in the retrieval mode operates continuously to play back the fields as long as one wishes to observe the retrieved document, thereby providing repetitive video frame signals to maintain the brightness of the monitor screen. This capability is valuable, for it obviates the need for a separate REFRESH memory which would be required when using a standard video tape recorder.

Optional "Refresh Memory" Used in Retrieval Mode

Although one of the major advantages of the multi-headed stationary tape system is to eliminate the need for a refresh memory in many cases, there are still advantages to using such a tape system in conjunction with a buffer.

Thus the arrangement in FIG. **11** is almost identical to that in FIG. **9** save that a Refresh Memory **100** has been added thereto. A memory suitable for this application is the Intel Corporation IN-65 charge-coupled device memory, typically incorporating about a million bits of solid state memory. Alternatively, other types of memory, such as video discs and image converters, may be used.

The major reason for incorporating an independent Refresh Memory is that a frame repetition rate of 15 per second does produce a flicker objectionable to some observers, particularly when used with a cathode ray tube having standard TV phosphors.

Refresh Memory **100**, which is interposed between video playback switching circuit **13**, and video monitor **15** is capable of accepting and recording a single four-field frame from the circuit **13** during a period of 1/15 second. Refresh Memory **100** then functions to present this image to video monitor **15** at the normal standard TV rate of 30 frames per second, **60** fields per second.

In this arrangement, the various advantages of a stationary tape system in accordance with the invention over moving tape will still be operative. These are:

(1) No buffer is needed during initial recording.

(2) Simplicity of synchronization.

(3) Simple stepping motion from frame to frame.

Scanning

Although the invention is not limited to any particular type of scanning system, inasmuch as the video information contained within a single frame is divided into a number of fields, the number should always be equal to the number of heads used in the rotating head assembly. Thus instead of four fields, one may use six fields and hence a six-headed recorder. Or instead of a single arm, each head may be on a separate arm which is angularly displaced from the other arms.

In the example given, which makes use of four fields and four heads, in order to prevent flicker, these fields should be interlaced, such interlacing being well known in the art. All video recording heads are preferably at some multiple of 180° from each other so that as one head leaves its associated track, the next head in the recording sequence then enters its associated track.

In order to provide a simple example and to explain the principles underlying the invention, the number of horizontal scan lines per frame has been given as 1050. This number of scan lines is perfectly feasible. However, the most common method of producing interlaced fields is predicated on having each new field start after a fraction of the preceding line. Thus, a system more compatible with present day standards would be one having 1049 total scan lines per frame. Dividing 1049 by four equal length fields results in the first field ending at 2621/4, the second field ending at 5241/2, the third field ending at 7863/4, and the fourth field ending at 1049. But if one wishes to use 1050 scan lines, it is merely necessary to develop a small vertical offset voltage which is present during alternate fields.

While there has been shown and described a preferred embodiment of a video system for storing and retrieving documentary information in accordance with the invention, it will be appreciated that many changes and modifications may be made therein without, however, departing from the essential spirit thereof. Thus while the system has been shown as including a camera and display tube at the same location, in practice, the display tube and a control terminal for selecting a particular document from the video file may be at a remote location linked to the central file by a conventional coaxial cable for low resolution video signals. The fields which are transmitted sequentially over this cable correspond to existing T-V standards and may be processed using standard equipment.

I claim:

1. A high-resolution video filing system for storing and retrieving documentary information, said system having a storage mode in which each document to be filed is electro-optically scanned and magnetically recorded and a retrieval mode in which a selected recording is played back and displayed to recreate the document in readable form, said system comprising:

A. a high-resolution video camera for scanning each document to be filed to produce a video signal representing a single image frame having a predetermined number of scan lines in excess of 1,000;

B. a multi-headed magnetic tape recorder having a rotating head assembly whose series of heads are offset with respect to each other in a direction normal to the plane of rotation and act to successively sweep across a stationary magnetic tape to record thereon in the storage mode of the system a

like series of parallel transverse tracks, each head being associated with a respective track, and in a retrieval mode to repeatedly play back the recorded tracks, said recorder including means to produce pulses representing the angular position of the rotating head assembly;

C. a high resolution video display device capable of reproducing said document in response to said video signal representing a single image frame;

D. electronic switching means coupled to said camera in the storage mode to divide said video signal representing a single image frame into fields equal in number to the number of said heads in said series thereof and to sequentially feed said fields to the respective heads of the recorder to record said fields on said tracks and to thereby produce a set thereof representing said document, and in the retrieval mode to sequentially feed the played-back fields to said display device to recreate said video signal representing a single image frame and thereby display said document; and

E. a synchronizing circuit responsive to the pulses representing the angular position of the head assembly to produce sync pulses for governing the operation of the electronic switching means.

2. A system as set forth in claim 1, further including means to record along the longitudinal edges of said tape address and locating data.

3. A system as set forth in claim 1, wherein said head assembly includes a rotating arm having two of said heads mounted on one end and the other two heads mounted on the other end, said video signal being divided into four fields which are applied sequentially to said four heads.

4. A system as set forth in claim 3, wherein said arm rotates in a plane extending through a gap between a pair of stationary cylinders, said tape being partially wrapped about said cylinders at an angle thereto, whereby said heads sweep across tape through said gap.

5. A system as set forth in claim 5, wherein said means to produce said pulses is constituted by a permanent magnet mounted to rotate with said arm and operatively coupled to two stationary transducers at diametrically-opposed positions to produce a pulse at each 180° position of said arm.

6. A system as set forth in claim 1, further including tape transport means to advance said stationary tape one step after each recording of a set of fields representing one document to be filed to present a fresh stationary tape zone to the recording heads for recording another document to be filed.

7. A system as set forth in claim 1, wherein said recorder includes an erase head to remove all recordings prior to entry of the tape into the rotating head assembly.

8. A system as set forth in claim 1, further including a refresh memory to store the video information of at least one of said frames during the retrieval mode and provided with means to repeatedly read-out said video information to said video display device.

9. A system as set forth in claim 8, wherein said refresh memory includes means which render it capable of storing said video information at one rate and reading out said information at another rate to avoid flicker.

10. A system as set forth in claim 1, wherein said recorder includes a tape transport mechanism adapted to step said tape from one stationary position to the next so as to record a set of fields at each position representing a distinct document for moving said tape forwards or backwards at a relatively high speed to locate a desired recorded set thereon.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 4,090,223 Dated May 16, 1978

Inventor(s) Arthur W. Holt

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 36, "means should read -- mean --.

Column 12, claim 5, line 1 "5" should read -- 4 --.

Signed and Sealed this

Seventeenth Day of *October 1978*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

DONALD W. BANNER
Commissioner of Patents and Trademarks

EXHIBIT 61

DICTIONARY OF
INDUSTRIAL DIGITAL COMPUTER TERMINOLOGY

Prepared by
Glossary Committee
Purdue Workshop on Standardization of
Industrial Computer Languages

DICTIONARY OF INDUSTRIAL DIGITAL COMPUTER TERMINOLOGY

Prepared by

Glossary Committee
Purdue Workshop on Standardization of
Industrial Computer Languages

Sponsored by
Purdue University
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and

Data Handling and Computation Division
of the
Instrument Society of America

INSTRUMENT SOCIETY OF AMERICA
PITTSBURGH

INSTRUMENT SOCIETY OF AMERICA

THE SOCIETY

The Instrument Society of America is a technical, scientific and educational organization serving users and manufacturers of equipment and systems for measurement and automatic control. ISA publishes reference books, standards and meeting proceedings in all areas of industry, science and technology. Write for detailed membership information or a current publications catalog.

RELATED PUBLICATIONS

The following books in the area of Industrial Digital Computer Control are published by ISA; availability and prices, as of 1972.

Progress in Direct Digital Control, Edited by T. J. Williams and F. M. Ryan. Definitive articles on developments and applications of DDC concepts in the process industries from 1962-1969, plus additional information for the Purdue Workshop. (300 pp, illus., $20.00)

ISA-PR55.1 Hardware Testing of Digital Process Computers. General recommendations applicable to all hardware testing, specific tests for pertinent subsystems and system parameters. Identifies tests to be used and provides recommended procedures. (56 pp, $5.00)

ISA is the Distributor of major publications of the International Federation of Automatic Control (IFAC).

IFAC Multilingual Dictionary of Automatic Control Terminology, edited by D. T. Broadbent. 650 commonly used automatic control terms in six languages: English, French, German, Italian, Russian and Spanish. (375 pp, $9.00)

Digital Computer Applications to Process Control, Volume 3, edited by W. E. Miller and A. Niemi. Proceedings of the 3rd IFAC/IFIP Conference on the topic, Helsinki, Finland, 1971. 66 technical papers, plus transcriptions of author/attendee discussion and panel sessions. Proceedings of 1st and 2nd symposium are also available. (650 pp, $42.00)

Interface with the Process Control Computer, edited by T. J. Williams. Contains 33 papers presented at the IFAC symposium held at Purdue University, 1971. (244 pp, $15.00)

Proceedings of the 5th IFAC World Congress. Four hard bound volumes containing 230 papers. Available following the Congress, June, 1972; write for detailed information.

Library of Congress Catalog Card No. 72-81778
ISBN 87664-184-2

400 Stanwix Street
Pittsburgh, Pennsylvania 15222

of the difference, between the number that has been executed and the number of repetitions desired. (1)

cycle stealing — The delaying of the program during execution of an instruction to store a data word available on a channel without changing the logical condition of the central processor and without changing the contents of the instruction register.

cycle time — The basic unit of computer speed, usually the time required for a read and a write operation in core memory. (2)

cyclic code — A form of gray code, used for expressing numbers in which, when coded values are arranged in the numeric order of the real values, each digit of the coded value assumes its entire range of values alternately in ascending and descending order, e.g., for cyclic decimal:

REAL	CODED
00-09	00-09
10-19	19-10
20-29	20-29
30-39	39-30

cyclic redundancy check character (CRC) — A character used in a modified cyclic code for error detection and correction. (5)

cyclic shift — A shift in which the data moved out of one end of the storing register are reentered into the other end, as in a closed loop. (4)

D/A — Abbreviation for *digital-to-analog*

D/A converter — See *digital-to-analog converter.*

damping — The decrease in amplitude of an oscillation due to the dissipation of energy. It is built into electrical circuits and mechanical systems to prevent rapid or excessive corrections which may lead to instability or oscillatory conditions, e.g., connecting a resistor on the terminals of a pulse transformer to remove natural oscillations or placing a moving element in oil or sluggish grease to prevent mechanical overshoot of the moving parts.

data — Information operated on during program execution.

data age — Time at which a datum was obtained.

data area — A portion of storage used during the execution of a segment (the storage is not necessarily contiguous or of fixed size).

data bank — A comprehensive collection of data, for example, several automated files, a library, or a set of loaded discs. Synonymous with *data base.* (8)

data base — See *data bank.*

data channel — A bidirectional data path between I/O devices and the main memory of a digital computer. Data channels permit one or more I/O operations to proceed concurrently with computation thereby enhancing computer performance. (14)

data code — A structured set of characters used to represent the data items of a data element, for example, the data codes 1, 2, . . ., 7 may be used to represent the data items Sunday, Monday, . . ., Saturday. (5)

data collection — The act of bringing data from one or more points to a central point. (5)

data communication — The transmission of data from one point to another. (5)

data control block — A control block through which the information required by access routines to store and retrieve data is communicated to them. (5)

data conversion — Same as *conversion 1.*

data display module — A device which stores computer output and translates this output into signals which are distributed to a program-determined group of lights, annunciators, numerical indicators, and cathode ray tubes in operator consoles and remote stations.

data element — A scalar, array, or structure.

data error — A deviation from correctness in data, usually an error, which occurred prior to processing the data. (1)

data exchange — To interchange the contents of two storage devices, locations, or systems.

data flow diagram — See *data flowchart.*

data flowchart — A flowchart representing the path of data through a problem solution. It defines the major phases of the processing as well as the various data media used. Synonymous with *data flow diagram.* (6)

data gathering — See *data collection.*

data handling — Same as *data processing.*

data hierarchy — A data structure consisting of sets and subsets such that every subset of a set is of lower rank than the data of the set. (5)

data item — The name for an individual member of a set of data denoted by a data element, for example, the data item "Tuesday" is a member

EKC000156047

EXHIBIT 62

SEALED DOCUMENT

EXHIBIT 63

SEALED DOCUMENT

EXHIBIT 64

SEALED DOCUMENT

EXHIBIT 65

Volume 1, Pages 1-213

Exhibits: 1-7; Index: 213

UNITED STATES INTERNATIONAL TRADE COMMISSION

WASHINGTON, D.C.

Before the Honorable Robert L. Barton, Jr.

Administrative Law Judge

Investigation No. 337-TA-527

In the Matter of

CERTAIN DIGITAL IMAGE STORAGE

ORIGINAL

AND RETRIEVAL DEVICES

VIDEOTAPED DEPOSITION OF CHRISTOPHER FREDERICK HEROT

Tuesday, June 14, 2005, 9:11 a.m.

Ropes & Gray LLP

One International Place

Boston, Massachusetts

-------Reporter: Alan H. Brock, RDR, CRR------

system, a high-speed output to the video display. That's kind of a central feature of the operation of the underlying -- the patented system, regardless of exactly the mechanism that was implemented. 10:41:07 10:41:11 10:41:14 10:41:21

Q. Do you have an opinion as to whether the mechanism required by Claim 8 of the '121 patent would require physically separate pins? 10:41:24 10:41:27 10:41:32

A. I think that's really an implementation decision. 10:41:36 10:41:38

Q. If I could refer your attention to the second element of Claim 8 of the '121 patent, "said video pixel data representing the full-size video image at a first resolution being stored in a first group of memory locations in said random-access memory means." Do you see that? 10:41:43 10:41:45 10:41:49 10:41:53 10:41:54 10:41:57

A. Yes. 10:41:58

Q. Did you consider the meaning of the term "first group of memory locations" in formulating your opinions on Claim 8 of the '121 patent? 10:41:59 10:42:01 10:42:04

A. Yes. 10:42:09

Q. What did you consider "first group of memory locations" to mean? 10:42:09 10:42:11

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UNITED STATES INTERNATIONAL TRADE COMMISSION

WASHINGTON, D.C.

Before the Hon. Robert L. Barton, Jr.,

Administrative Law Judge

ORIGINAL

* * * * * * * * * * * * * * * *

In the Matter of *

Certain Digital Image Storage * Investigation

and Retrieval Devices * No. 337-TA-527

* * * * * * * * * * * * * * * *

Video Deposition of Christopher F. Herot

Wednesday, June 15, 2005

Ropes & Gray LLP

One International Place

Boston, Massachusetts 02110

----------- J. EDWARD VARALLO, RMR, CRR ----------

COURT REPORTER

Lexidata display to the PDP-11/70; that does not 09:57:47
show any intervening boxes or circuitry. 09:57:52
Q. And the frame buffers for the Lexidata 09:57:57
display are within the box labeled Lexidata display? 09:57:59
A. That is correct. 09:58:01
Q. If I could turn your attention, please, to 09:58:13
the sixth element of claim 8 of the '121 patent. Do 09:58:14
you see that claim element? 09:58:19
A. It's the one that starts with "Said 09:58:20
control means?" 09:58:23
Q. Yes. 09:58:25
A. Yes, I see it. 09:58:26
Q. Do you see the language in the middle of 09:58:32
the sixth element of claim 8 of the '121 patent 09:58:36
which reads "for causing the selective transfer from 09:58:39
said bulk storage memory directly into said random 09:58:42
access memory means"? 09:58:45
A. "For causing the selective transfer from 09:58:57
said bulk storage memory directly into said random 09:58:58
access memory means," yes. Okay. 09:59:02
Q. Did the SDMS transfer data for full-size 09:59:12
images directly from bulk storage to random access 09:59:21

memory? 09:59:25

A. Yeah, but I would use -- You know, let me 09:59:33
qualify that, though, or just be more precise about 09:59:38
that. In most cases when we were talking about 09:59:41
random access memory and what mapped between what in 09:59:46
the '121 patent as random access memory and in SDMS 09:59:52
as random access memory, we used the Lexidata 09:59:55
display as the random access memory. 10:00:00

To be more precise, though, there are 10:00:03
really several ways you could implement a frame 10:00:08
buffer display circa 1980. The way the PDP-11/70 10:00:10
SDMS system worked was it had some memory in the 10:00:18
PDP-11/70 that was used for various reasons, 10:00:22
including buffering I/O from the disk, and then it 10:00:24
had memory in the Lexidata display that was the 10:00:29
frame buffer that was actually used to refresh the 10:00:33
screen. 10:00:36

There are some other architectures like, 10:00:37
just as an example, the M.I.T. SDMS that I know has 10:00:43
been cited elsewhere, but I didn't really rely on it 10:00:49
in preparing this paper, but just as an example 10:00:50
where that memory is all one system. 10:00:53

So the way the data actually moved from the disk to the Lexidata display was the PDP-11/70, which is the control means in SDMS, maps to the control means in the '121 patent. It would instruct the disk drive to transfer some data to the PDP-11/70 memory because that's the memory path that was set up in the PDP-11. And then PDP-11 would have that data transferred from what's called the core memory here on Figure 1.4; it would transfer it from there to the Lexidata display. 10:00:57 10:01:02 10:01:05 10:01:09 10:01:13 10:01:17 10:01:21 10:01:25 10:01:30 10:01:34

Now, I still consider that direct because it never actually passed through the processor. The control means just used the core memory as an intermediate buffer to move the data between those two places. 10:01:37 10:01:40 10:01:43 10:01:48 10:01:52

Q. Could you explain what you mean by it never actually passed through the processor? 10:01:55 10:01:57

A. Well, there's typically two ways you can write information with a computer, especially in 1980. One was that you actually have information that was in some register of the computer and you'd write it explicitly to a device. And then the other 10:01:59 10:02:02 10:02:05 10:02:09 10:02:11

would be that you would issue some command to the device -- Remember in the -- Sorry. Shouldn't say remember. 10:02:16 10:02:19 10:02:22

I remember that the way unibus devices worked, which is what the PDP-11/70 was, was that the devices were all relatively intelligent, so you could tell a device like a disk drive to read or write some information from the disk drive to a particular memory location. And then that would happen without the processor actually having to touch the data in the sense that it would move on the unibus without going through the processing unit itself. 10:02:23 10:02:26 10:02:31 10:02:33 10:02:36 10:02:38 10:02:42 10:02:43 10:02:46 10:02:49

And it's the same way that -- Or in this case, to be precise, the 11/70 had a separate high-speed bus, which is what this line is that connects the 11/70 to the RP04 disk drive. And similarly when it moved from the core memory to the Lexidata display, the 11/70 would just tell the Lexidata display go get this memory, go get this data from this location, and then it would move over the unibus directly from the memory to the Lexidata 10:02:50 10:02:53 10:02:56 10:02:58 10:03:05 10:03:07 10:03:10 10:03:13 10:03:15

display without the processor actually being 10:03:20
involved during the actual transfer. 10:03:22
Q. As data was transferred from the RP04 disk 10:03:27
to the frame buffers of the Lexidata display, would 10:03:34
that data be buffered in the core memory of the 10:03:37
PDP-11/70? 10:03:40
A. Yes, that's correct. That's what I said. 10:03:43
MR. SCHOENHARD: I guess we've been going 10:04:03
for about an hour, so let's take our first break. 10:04:04
MR. WALDEN: That's good. 10:04:07
THE VIDEOGRAPHER: We are now going off 10:04:08
the record. The time is 10:04 a.m. 10:04:09
(Short recess taken.) 10:04:12
THE VIDEOGRAPHER: We are now back on the 10:13:07
record. The time is 10:23 a.m. 10:23:05
BY MR. SCHOENHARD: 10:23:13
Q. If I could turn your attention, please, 10:23:14
back to claim 7 of the '121 patent and specifically 10:23:15
the first element, random access memory means. Do 10:23:17
you see that? 10:23:21
A. Yes. 10:23:21
Q. And as we've discussed, I believe, the 10:23:23

EXHIBIT 66

SEALED DOCUMENT

EXHIBIT 67

09:07:25

09:07:25 IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

-----------------------------------x

AMPEX CORPORATION,

Plaintiff,

ORIGINAL

C.A. No.

-against- 04-1373-KAJ

EASTMAN KODAK COMPANY, ALTEK CORPORATION and CHINON INDUSTRIES, INC.,

Defendants.

-----------------------------------x

May 3, 2006

9:35 a.m.

Videotaped Deposition of BRAD A. MYERS, taken by Plaintiff, pursuant to Notice, at the offices of Ropes & Gray, 1251 Avenue of the Americas, New York, New York, before TAMMEY M. PASTOR, a Registered Professional Reporter, Certified LiveNote Reporter and Notary Public within and for the State of New York.

BRAD A. MYERS

identified as the size reducer of claim 8?

MR. SOUTO: Objection to the extent it mischaracterizes Dr. Myers' testimony.

A. I think in mapping this claim to the SDMS under Ampex's construction, we can see the direct transfer of the full size image from the frame buffer to the size reducer along the path that you just said.

Q. And under Kodak's construction?

A. Since it has to go from one memory to another memory, I'm not sure that would qualify as having no circuit in between. The memory and the size reducer. So I am not sure it would qualify under the construction where direct means there is no circuit in between.

Q. Referring to the core memory of the PDP-11/70, do you know whether that memory was dual ported?

A. I don't think it was.

Q. Referring to paragraphs 150 and 151 of your Expert Report on page 51. Do you see those paragraphs?

EXHIBIT 68

SEALED DOCUMENT

EXHIBIT 69

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

AMPEX CORPORATION,

Plaintiff,

vs. C.A. No. 04-1373(KAJ)

EASTMAN KODAK COMPANY,

ALTEK CORPORATION, and

CHINON INDUSTRIES, INC.,

Defendants.

DEPOSITION OF

YOSHIJI HARADA

February 17, 2006

CERTIFIED COPY

REPORTED BY: JANIS L. JENNINGS CSR NO. 3942

JOB No. 2001-377878

picture is written into picture memory 2, the next step is that it's written to disk 3 from the picture memory 2?

A. So the picture memory 2, the full size picture which was written into the picture memory 2 is going to be stored in disk 3. But at the time when the next memory is written and then when it confirms that the pictures were transferred to the reduced size picture below that, then those data are cleared from disk.

MR. STEINBERG: Are cleared from disk?

THE WITNESS: Are cleared from memory. And then the next pictures which are going to be written would be called immediately. Would be read immediately.

BY MR. BEAMER:

Q. Is it correct that these memory 2, 1-16th memory 42, and picture memory 8 and index memory 51 are depicted here as memories that have a single input-output port? It is bi-directional?

A. Also auxiliary memory after that is also bi-directional which can read and write.

INTERPRETER FIELD: I'm not sure if he heard single port, input and output are in a single port in the translation.

BY MR. BEAMER:

Q. So there's never an instance where a memory

has to be read and written at the same time; correct?
A. It can. It won't create any problem but there was no instance like that.
Q. So these are not dual port memories; is that right?
A. Dual port memory? I have no recollection whether it was dual or not. I don't think -- I don't have a clear recollection, although I don't think it was dual port because there was no necessity for that.
Q. Now, back on Exhibit 4 -- I'm sorry -- Exhibit 3, the figure on page 816, if you could turn to that. The last three digits 816.
MR. STEINBERG: From which exhibit?
MR. BEAMER: 3.
BY MR. BEAMER:
Q. That shows a squeezer or size reducer block 4 without any of the details that we were just looking at in the other figure in Exhibit 5; right?
A. That's correct.
Q. And do you recall that the original application that was filed in January of 1983 did not include figure 6 or any description of figure 6 of the patent?
A. As I said many times, since I haven't seen these documents, I do not know. So the drawing 6 shows

Q. So one way of implementing the size reducer would be to store the reduced size memory in a 58 line register of a bucket brigade device; right?

A. I'm not familiar with the portion, the description of this portion.

Q. Well, just setting aside the document. Can you say whether or not in your own knowledge of what you were doing at the time whether you could have used a bucket brigade device made up of 58 line registers instead of the 1-16th size memory that is shown in figure 6?

A. In my understanding charge coupled device was used to process output of pixels of shooted (sic) picture at that time, at the time that this machine was made. So I didn't specify or I didn't designate what kind of mechanism should be used to the manufacturer when writing and reading pictures. So I do not have any clear recollection what kind of memory was used.

Q. Well, aside from what was actually used, couldn't a bucket brigade device with 58 line registers have been used as the memory that held the reduced size picture before it was written to disk?

A. Yes.

Q. And that would not be a random access memory; correct?

A. Since it is bucket, no, it is not random memory.

Q. In the patent, Exhibit 2, in column 1, line 47, there is a reference to another application --

INTERPRETER FIELD: We haven't found the document.

MR. BEAMER: Sorry. Exhibit 2.

INTERPRETER FIELD: Is that page 759? No.

MR. BEAMER: I'm sorry. Column 1, line 47, there's a reference to serial No. 437317.

And I'll ask the reporter to mark what I understand to be the file history of that abandoned application. It is numbered AX204351 through 446.

(Whereupon, Plaintiff's Exhibit 6 was marked for identification.)

BY MR. BEAMER:

Q. And my question is, first, have you ever seen this document before, Exhibit 6?

A. No.

Q. The only inventor named in this application is Mr. Mikado. Do you see that? And in particular if you could turn to the document beginning at AX204371.

So do you see that either on this page or the next page that Mr. Mikado is the inventor and his company is the assignee?

EXHIBIT 70

UNITED STATES DISTRICT COURT

DISTRICT OF DELAWARE

Civil Action No.

04-1373-KAJ

****

AMPEX CORPORATION,

Plaintiff,

v.

EASTMAN KODAK COMPANY, ALTEK CORPORATION and CHINON INDUSTRIES, INC.,

ORIGINAL

Defendants.

****

VIDEOTAPED DEPOSITION OF DIETER W. PREUSS, PhD, a witness called on behalf of the Plaintiff, taken pursuant to the Federal Rules of Civil Procedure, before Maureen O'Connor Pollard, RPR, CLR, and Notary Public within and for the Commonwealth of Massachusetts, at the offices of Ropes & Gray, LLP, One International Place, Boston, Massachusetts, on the 5th of May, 2006, commencing at 9:29 o'clock a.m.

11:24:58 port which also had separate pins, yes.

11:25:02 Q. Is there any disclosure of the image
11:25:06 memories in the Combiskop station having
11:25:11 separate input and output ports which also had
11:25:14 separate pins in any of the documents on which
11:25:18 you relied in forming your opinions in this
11:25:20 case?

11:25:20 A. I don't think so.

11:25:20 MR. HIRSCH: Hold on. Hold on.
11:25:23 Objection.
11:25:23 Go ahead.

11:25:24 A. I don't think so. But definitely I
11:25:29 know that it was exactly like this, as I told
11:25:30 you. And this would have been a level of
11:25:34 such -- such a deep level of technical detail
11:25:37 which we certainly would not have disclosed in
11:25:40 any publication, therefore it's probably nowhere
11:25:45 in the documents.

11:25:46 BY MR. SCHOENHARD:

11:25:47 Q. Is there any disclosure of the random
11:25:50 access memory associated with the mini-computer
11:25:52 at the Scan/Reco station having separate input
11:25:58 and output ports with physically separate pins
11:26:01 in any of the documents on which you relied in

11:26:03 forming your opinions in this case?
11:26:04 MR. HIRSCH: Objection.
11:26:12 A. There can't be because it didn't have
11:26:14 separate input and output ports, it was just the
11:26:17 computer memory which had one port used for
11:26:23 input and output.
11:26:25 BY MR. SCHOENHARD:
11:26:26 Q. Is there any disclosure of the random
11:26:28 access memory associated with the mini-computer
11:26:32 at the Combiskop station having separate input
11:26:35 and output ports with physically separate pins
11:26:38 in any of the documents on which you relied in
11:26:41 forming your opinions in this case?
11:26:42 MR. HIRSCH: Objection.
11:26:43 A. Also the random access memory
11:26:45 associated with the Combiskop mini-computer was
11:26:51 normal computer RAM, or random access memory,
11:26:54 which had one port used for input and output.
11:26:58 BY MR. SCHOENHARD:
11:27:00 Q. Is there any disclosure of the random
11:27:01 access memory in the size reducer of the
11:27:04 Scan/Reco station have been separate input and
11:27:07 output ports with physically separate pins in
11:27:10 any of the documents on which you relied in

11:27:12 forming your opinions in this case?
11:27:14 MR. HIRSCH: Objection.
11:27:15 A. There is certainly no disclosure of
11:27:20 this in the document because this again was a
11:27:23 level of detail which we wouldn't like to
11:27:25 disclose to competitors.
11:27:27 BY MR. SCHOENHARD:
11:27:29 Q. Do you know whether the random access
11:27:32 memory associated with the size reducer in the
11:27:35 Scan/Reco station of the Hell Chromacom system
11:27:38 had separate input and output ports with
11:27:41 physically separate pins?
11:27:43 A. I know that it had not. It had one
11:27:46 port like a normal computer RAM also for input
11:27:49 and output.
11:27:50 Q. Please direct your attention to
11:27:53 paragraph 45 on page sixteen of your expert
11:27:56 report.
11:27:58 Do you see that paragraph?
11:27:59 A. Yes, I see it.
11:28:01 Q. At the end of the fourth line of that
11:28:12 paragraph carrying over to the fifth line, do
11:28:15 you see the term "the image input from the
11:28:17 scanner"?

14:34:58 Q. Please direct your attention to
14:35:02 paragraph 79 on page 27 of your expert report.
14:35:08 A. Yes, I have it.
14:35:09 Q. Do you see that paragraph?
14:35:10 A. Yes.
14:35:10 Q. The last sentence reads "the
14:35:14 multi-layered memory had an input port and a
14:35:16 separate output port."
14:35:18 What do you mean by that?
14:35:19 A. The multi-layered memory was the image
14:35:25 memory in the Imager console, and it had
14:35:30 separate input and output ports, exactly like in
14:35:38 our Chromacom system the image memory had.
14:35:41 Q. Would you say that the multi-layered
14:35:45 memory in the Scitex Response-300 system was
14:35:48 dual ported?
14:35:50 MR. HIRSCH: Objection.
14:35:51 A. It had a separate input and output
14:35:57 port, I can only say that.
14:35:59 BY MR. SCHOENHARD:
14:36:03 Q. Did the multi-layered memory in the
14:36:04 Scitex Response-300 system have separate input
14:36:07 and output ports with physically separate pins?
14:36:11 MR. HIRSCH: Objection.

14:36:12 A. This I can't -- I've not designed the
14:36:21 system. I only know there were separate input
14:36:24 and output ports for the multi-layered memory
14:36:28 which could be concluded from watching the
14:36:30 system and the speed at which images were
14:36:33 loaded.
14:36:34 BY MR. SCHOENHARD:
14:36:35 Q. Are you aware, are you aware of any
14:36:36 documents on which you relied in formulating
14:36:39 your opinions in this case that disclose whether
14:36:42 the multi-layered memory in the Scitex
14:36:44 Response-300 system had separate input and
14:36:47 output ports with physically separate pins?
14:36:50 MR. HIRSCH: Objection.
14:36:53 A. I don't rely on any documents
14:37:05 disclosing that the multi-layered memory had a
14:37:08 separate input and output port in its
14:37:10 multi-layered memory. I concluded it from
14:37:14 watching the system, as I said before, and I was
14:37:17 very sure -- I am still very sure that it is
14:37:22 exactly like this.
14:37:23 BY MR. SCHOENHARD:
14:37:23 Q. Do you know whether the random access
14:37:26 memory associated with the multiple computers of

14:37:28 the system had separate input and output ports
14:37:31 with physically separate pins?
14:37:39 A. Well, these were just normal
14:37:43 mini-computers from Hewlett-Packard which had
14:37:45 just normal computer memory, and that has just
14:37:49 one input/output, combined input/output port
14:37:54 where both input and output can be done through
14:37:57 the same port.
14:38:06 Q. Please direct your attention to
14:38:09 paragraph 82 on page 28 of your expert report.
14:38:11 Do you see that paragraph?
14:38:12 A. Yes, I have this.
14:38:14 Q. Do you see the sentence which reads
14:38:23 "for instance, the input full size image could
14:38:25 be stored on disk"?
14:38:27 A. I see the sentence, yes.
14:38:28 Q. Is the input full size image to which
14:38:33 you refer the image that would be scanned into
14:38:38 the Scitex Response-300 system?
14:38:40 A. Yes, it is the full size image that is
14:38:46 coming in from the scanner into the Scitex
14:38:47 system and then stored on disk.
14:38:50 Q. In performing your analysis of the
14:38:52 asserted claims of the '121 patent in light of

EXHIBIT 71

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of Daniel A. Beaulier Serial No.: 018,786 Filed: February 24, 1987 For: ELECTRONIC STILL STORE WITH HIGH SPEED SORTING AND METHOD OF OPERATION	Group Art Unit: 262 Examiner: D. Harvey Attorney Docket No.: AV-3033 N2 I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D. C. 20231, on Oct. 5, 1988 George B. Almeida 10/5/88 George B. Almeida, Reg. # 20,696 DATE

AMENDMENT UNDER 37 CFR 1.116

"6"

Hon. Commissioner of Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

In response to the Office Action dated July 22,1988 finally rejecting the claims, and as provided by 37 CFR 1.116, entry of the following amendment as placing the above-identified application in condition for allowance, or in better form for appeal, is respectfully requested.

IN THE CLAIMS

Claims 16, 17 please cancel without prejudice.

18. (twice amended) An apparatus for storing video pixel data representing video images of a first resolution and, for each each of the images at said first resolution, a

corresponding video image at a second resolution, comprising:

random access memory means for individually storing video pixel data representing one of a succession of full size images at said first resolution and a corresponding reduced size version thereof at said second resolution;

bulk memory means for receiving said video pixel data from said random access memory means and for storing said succession of full size images and the corresponding reduced size versions thereof, and for outputting upon a user's command, either a selected one of the successive full size images or selected ones of [only] the corresponding reduced size versions thereof for direct transfer to, and storage back in, said random access memory means; and

means responsive to said random access memory means for selectively generating one of said corresponding reduced size versions from the respective full size image in said random access memory means, and for transferring the video pixel data representing said full size image and the corresponding reduced size version back [image] to the contents of said [memory means via said] random access memory means.

Claim 19, line 24, after "resolution" insert

--directly back--;

line 44, after "storage memory" insert

--directly--

Claims 20, 21, please cancel without prejudice.

23. (twice amended) A system for storing video data representing video images which are displayable as rasters of vertically distributed horizontal lines, each represented video image normally occupying a raster of selected vertical and horizontal size, the system comprising:

a video image size reducer having an input for receiving video data representing a video image corresponding to the selected raster size and for generating video data representing a reproduction of said video image at a selected fractional-size of said selected raster size;

a first store for receiving video data for storage and for providing video data therefrom, said first store having a capacity for storing the video data representing a video image corresponding to the selected raster size simultaneously together with video data supplied by said video image size reducer representing said reproduction of a video image at the selected fractional-size;

a second store for receiving and storing both the video data from the first store and for providing video data therefrom directly to the first store, said second store having a capacity for storing video data representing a plurality of video images each corresponding to the selected

raster size, and video data representing a plurality of the reproductions of each video image at the selected fractional size of said selected raster size; and

means for selectively transferring from said second store <u>directly</u> to said first store either said video data representing of the plurality of video images corresponding to the selected raster size, or said video data representing the plurality of reproductions of each video image at the selected fractional-size of said selected raster size.

Claim 26, please cancel without prejudice.

29. (amended) A method of storing video pixel data for access and display comprising:

providing data sets for a plurality of full size images at a first spatial resolution;

generating, from the data sets of the full size images, <u>a</u> second data set[s] representing a corresponding plurality of reduced size reproduction images at a second lower spatial resolution;

storing both the data sets of the plurality of full size images and the data set[s] of the corresponding plurality of reduced size reproduction images in respective selected groups of storage locations; and

selectively accessing [either] one of the data sets of the plurality of full size images<u>,</u> or the set[s] of

the corresponding plurality of the reduced size reproduction images simultaneously.

Please add the following new Claims 30 and 31 to replace original Claims 20 and 26 respectively.

--30. An apparatus for storing video pixel data as at least one full size image at a first resolution, and at least one reduced size image thereof at a second lower resolution, comprising:

random access memory means having an input port and an output port, for storing the video pixel data presented at the input port;

said video pixel data representing the full size video image at a first resolution being stored in a first group of memory locations in said random access memory means;

bulk storage memory for also storing the video pixel data and for presenting selected groups of video data at said input port for storage by said random access memory means;

size reducing means responsive to said random access memory means for receiving said video pixel data stored in said random access memory means representing said full size image at said first resolution, and for reducing said image to the reduced size image at the second lower resolution, and for supplying said reduced size image at

said second resolution to said random access memory means in a second group of memory locations therein;

control means coupled to said random access memory means, to said bulk storage memory and to said size reducing means, for causing said size reducing means to generate said reduced size image at said second resolution and to supply same to said random access memory means in said second group of memory locations;

said control means further causing the transfer of the full size and reduced size video pixel data from said random access memory means to said bulk storage memory for storage, and for causing the selective transfer from said bulk storage memory into said random access memory means of either said full size image at said first resolution or said reduced size image at said second lower resolution; and

wherein said control means also determines the selective transfer of said reduced size image at said second resolution from said size reducing means into said bulk storage memory via the random access memory means.--

--31. A method of storing video pixel data for access and display comprising:

providing data sets for a plurality of full size image at a first spatial resolution, wherein each one of the full size images occupies upon display a raster of selected vertical and horizontal size;

generating, from the data sets of the full size images, a second data set representing a corresponding plurality of reduced size reproduction images at a second lower spatial resolution;

storing both the data sets of the plurality of full size images and the data set of the corresponding plurality of reduced size reproduction images in respective selected groups of storage locations;

selectively accessing one of the data sets of the plurality of full size images, or the set of the corresponding plurality of the reduced size reproduction images simultaneously;

wherein the step of accessing further includes, retrieving the plurality of reproductions of each video image, storing the plurality of reproductions in a random access memory, and outputting the stored plurality of reproductions as a mosaic of reproduction images occupying a raster of the selected vertical and horizontal size.--

REMARKS

By this amendment, Claims 16, 17, 20, 21 and 26 are cancelled without prejudice, Claims 18, 19, 23, are variously amended and Claims 20 and 26 are re-written as new Claims 30 and 31, respectively, to make them independent and to include all the limitations of the respective base claim, as suggested by the Examiner. Applicant notes with

appreciation the allowance of Claims 2, 4, 6, 7, 15, 27 and 28 and the indication of allowability of Claims 20 and 26 if re-written.

In his Office Action, the Examiner finally rejected Claims 3, 22, 29 under 35 USC 112, second paragraph, as indefinite; finally rejected Claims 16-19, 21, 23-26 under 35 USC 102(b) as anticipated by Taylor et al; indicated the allowability of Claims 20, 26 if re-written, and allowed Claims 2, 4, 6, 7, 15, 27 and 28.

Regarding the rejection under 35 USC 112, applicant has deleted the word "either" from Claim 29, line 13, and added a comma (,) to line 14, thereby clarifying that the accessing is done to one of the... full size images, <u>or</u> to the reduced size reproduction images in a set simultaneously. Thus the confusion is believed removed.

Regarding the Examiner's indication that the Claims 3 and 22 language of one-fourth the spatial resolution would cause the reduced images also to have one-fourth the size, applicant respectfully refers in particular to page 6, lines 14-18, wherein is stated that ,"Because of the two dimensional nature of a video image, a quarter size image defined by video having one-fourth the spatial resolution of a full size image requires one-sixteenth the storage capacity of a full size, full

spatial resolution image." (See also page 7, lines 10-14). Thus the language in the Claims 3 and 22 is, in fact, correct and definite. One-fourth the spatial resolution refers to each dimension, whereby if a picture (image) is one-fourth the width (horizontally) and one-fourth the height (vertically) it obviously takes up one-sixteenth of the full picture raster. That is, sixteen of the one-fourth resolution images would fit on the raster. Thus, applicant respectfully submits the language of Claims 3 and 22 is definite, and requests that the rejection thereof under 35 USC 112 be withdrawn.

Regarding the rejection of Claims 16-19, 21 and 23-26 under 35 USC 102 (b), applicant respectfully submits that the remaining Claims 18, 19, 23 and 26 (new Claim 31) are not fully met by the cited reference to Taylor et al. For example, Claim 18 recites, inter alia, a random access memory means (frame store 22) for individually storing...succession of full size images...and a corresponding reduced size version thereof at said second resolution (underlining added). Taylor et al fails to describe and does not intend the storage of both a reduced size and a full size image in his frame store (14/24 or 124/125) in the manner of applicant. In fact, any size reduction, and thus reduced size image, is made on the full size image only at the time the latter is transferred from the disk storage (18/20) to the frame store (24/124/125) as

depicted in FIG'S 5, 18 and 19, or from the frame store to the disc storage as depicted in FIG. 19. Applicant's invention on the other hand, as described and claimed, provides image reduction via his size reducer (26) coupled only to the frame store (22), and which receives the full size image only from the frame store whenever there is no reduced size image, and which then returns the reduced size image directly back to the frame store for storage thereof simultaneously with the corresponding full size image.

Contrary to the Examiner's statement in page 3, paragraph 3(a), of his Office Action, Taylor et al does not teach or imply that that his size reducer "does not necessarily provide expansion or reduction," and that "the size reducer may pass the image unchanged." Applicant has carefully reviewed the patent and fails to find therein any such description or implication. In the embodiments which include the size reducer, Taylor et al specifically employs an image size change each time a full size image is transferred between storage devices, and fails to imply that the size reducer may pass the image unchanged. If no size reduction is to be made, Taylor et al specifies merely omitting the size changing processor entirely (Col 5, lines 54-57). In any event, Taylor et al fails to store both the full size image and its reduced size version in his frame store as described and claimed by applicant.

In paragraph 3(b), page 3, of the Office Action, the Examiner notes that Taylor et al provides a size reducer output which is fed back to the frame store (but) via the disc store. Such a configuration fails to anticipate applicant's circuit configuration, wherein the size reducer 26 is directly coupled (only) to the frame store 22. This configuration allows applicant the advantages of high speed transfer of multiple, reduced size images in a single frame of video data. In the configuration of FIG'S 5, 18 or 19, Taylor et al must pass a frame of video data through his size changer 23 prior to supplying his frame store, whereupon he then accesses the frame store. Applicant respectfully submits that Taylor's use of a size changer between the two stores is an integral feature of his system, and that the re-arrangement thereof in the manner of applicant's system is made apparent only through hindsight and by application of the teachings of applicant.

Accordingly, Claims 18, 19 and 23 are variously amended herewith to further clarify the language thereof over the reference to Taylor et al. Claim 18 recites inter alia; a "random access memory means for... storing video pixel data representing... full size images... and a corresponding reduced size version thereof at said second resolution"; bulk memory means which stores both size images and which transfers either size of the images directly back to the random access memory means, with no other circuit

therebetween; and means for generating the reduced images from the full size images and returning both directly back to the contents of the random access memory means. Taylor et al fails to teach the above features of storing both image sizes simultaneously in the random access memory, the direct transfer of images between the disc storage and random access memory, or the transfer of images directly between the size reducer and only the random access memory.

Likewise, Claims 19 and 23 also recite the above features in differing language and terms, and thus are not anticipated by Taylor et al for the same reasons given above.

Claims 20 and 26 have been re-written as new Claims 30 and 31 as suggested by the Examiner, to include the limitations of the respective base claim, and new Claim 31 has been amended to overcome the 112 rejection as discussed above. Accordingly, applicant respectfully submits that claims 3,18,19, 22, 23, 29, 30 and 31, along with (allowed) Claims 2, 4, 6, 7, 15, 27 and 28, are in condition for allowance, which action is earnestly solicited.

If Examiner finds slight differences that can be resolved by a telephone interview, Applicant hereby requests

leave for such interview by telephoning the undersigned collect at (415) 367-3331.

If the Examiner persists in his final rejection of the subject application, applicant respectfully requests entry of the amendments for purposes of appeal.

Respectfully submitted,

AMPEX CORPORATION

By George B. Almeida

George B. Almeida
Agent of Applicant
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Dated: October 5, 1988
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EXHIBIT 72

SEALED DOCUMENT

EXHIBIT 73

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EXHIBIT 74

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EXHIBIT 76

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